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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

December 23, 2003

**BY HAND**

Ms Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S W
Washington, D.C 20554

Re: ***Ex Parte Presentation.***

In the Matter of Orbital Debris, IB Docket No. 02-54

Dear Ms Dortch:

Yesterday, December 22, 2003, Ruy Pinto, Director, Satellite Control and Navigation of Inmarsat Ltd, John P. Janka of Latham & Watkins, and the undersigned, met with the following Commission representatives: Roderick K. Porter, John Martin, Jackie Ruff, Sankar Persaud, Steven Spaeth, Karl Kensinger, Stephen Duall, and JoAnn Lucanik, all of the International Bureau Also in attendance were Bruce Olcott of Squire, Sander and Dempsey representing The Boeing Company ("Boeing") and Bruce Jacobs of Shaw Pittman representing Mobile Satellite Ventures. Attending by phone were Jeof McAllister, Tom Walsh and Henry Bazak, all of Boeing.

The topics discussed by Inmarsat were those described in the enclosed presentation. During the meeting, Karl Kensinger requested a clarification of Inmarsat's statement that its MSS programs are designed for a "standard 192 km de-orbit." By "standard," Inmarsat was referring to the industry de-orbiting best practices standard at the time Inmarsat's satellites were designed.

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An original and three copies are enclosed.

Respectfully submitted,

Alexander D. Hoehn-Saric

Enclosures

cc Roderick K. Porter
John Martin
Jackie Ruff
Sankar Persaud
Steven Spaeth
Karl Kensinger
Stephen Duall
JoAnn Lucanik
Ruy Pinto, Inmarsat Ltd
Bruce Olcott, Counsel to Boeing
Bruce Jacobs, Counsel to MSV

# FCC Presentation
# Orbital Debris
## IB Docket No. 02-54

Ruy Pinto
Director, Satellite Control and Navigation
22 December 2003



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# Inmarsat Concerns

- **Station keeping requirements for GSO MSS**
- **De-orbiting requirements for GSO MSS**



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# Critical Design Aspects of GSO MSS Spacecraft

- MSS terminals use omnidirectional/tracking antennas whose performance is not affected by N/S satellite drift
- As a result, GSO MSS systems are designed to use inclined orbits that take advantage of this terminal capability
- Inclined orbits conserve fuel, extend spacecraft life, and thereby support heavy payloads and large spacecraft
- In contrast, GSO FSS systems cannot use inclined orbits and serve a majority of their customers
  - FSS antenna beam patterns are highly directional to facilitate two-degree spacing; most FSS terminals do not have antenna tracking



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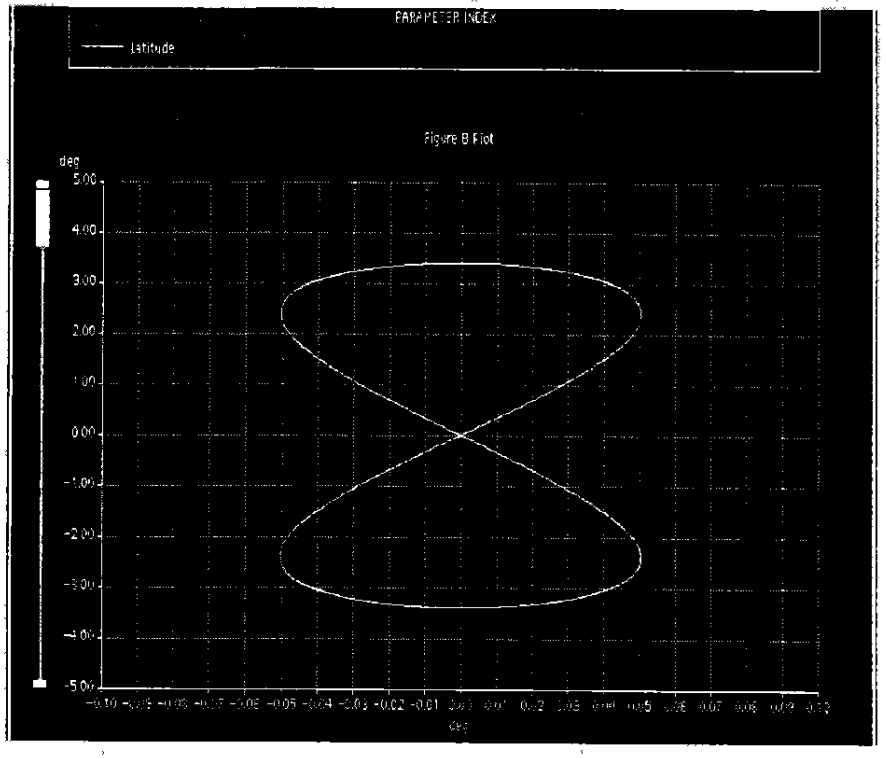
# Daily E/W Spacecraft Motion Due to Inclination and Eccentricity




- At 3.4 deg inclination, the daily E/W motion due to inclination alone completely fills a ±0.05 deg box
- Typical eccentricity values range from 0.0003 to 0.0006 which correspond to ±0.034 deg and ±0.067 deg respectively
- These factors increase the E/W motion of the orbit



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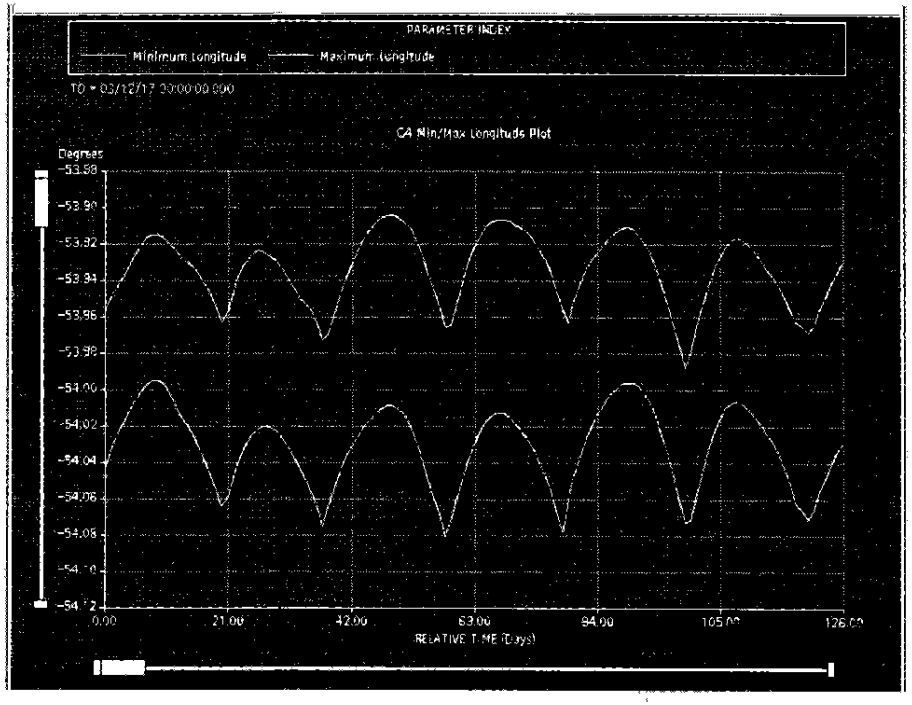
# EW motion due to longitude drift




- Depending on the local tangential acceleration at a given longitude, a satellite drifts from its on-station longitude
- Typical drift rates are of the order of 0.005 deg/day
- EWSK causes parabolic longitude excursions as shown (here every 3 weeks)
- The envelope shown encloses the daily longitude motion due to eccentricity with i= 0.1 deg



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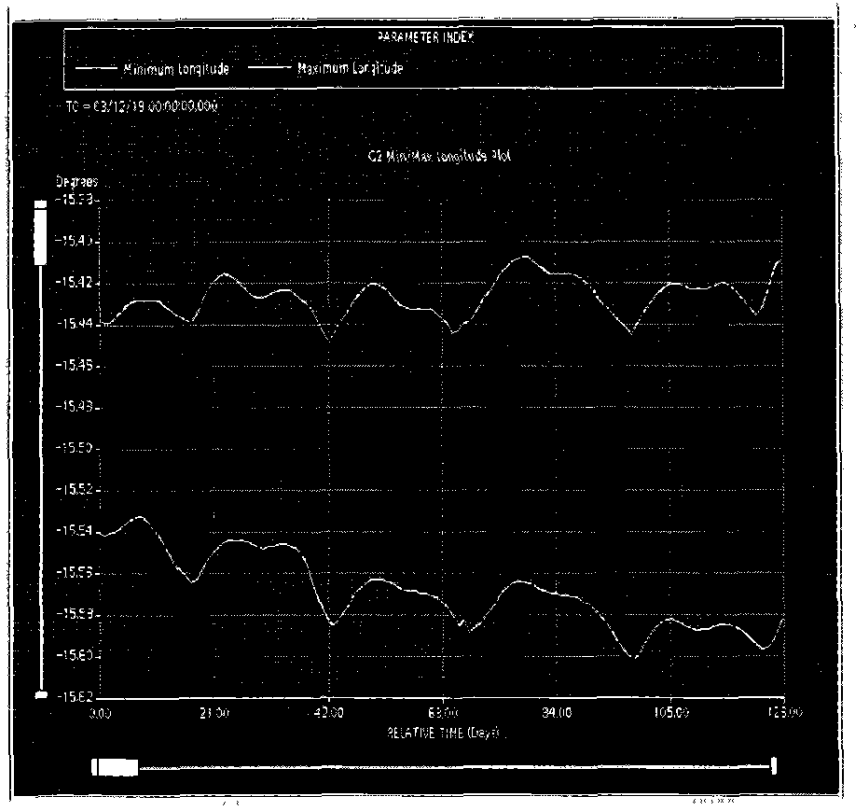
# Impact on Inmarsat 3 Satellites




- Current I3 strategy has NSSK at ±0.1 deg for 10 years, then EWSK only up to i = 3.0 deg
- EW cycles are either 3 or 4 weeks, depending on the on-station longitude
- Reducing EWSK box to ±0.05 deg requires increasing the frequency of EW burns.
- A ±0.05 deg box also requires 2-burn EW strategy in order to reduce eccentricity and hence, daily longitude excursion. An example of why is shown at left
- A 2-burn strategy increases fuel usage by a factor of 5 for EW manoeuvres



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# Stationkeeping of Inmarsat Spacecraft

- Inmarsat MSS spacecraft support inclined orbit operations at up to 5 degrees for global beams
- Inmarsat MSS spacecraft support inclined orbit operations at up to 3 degrees for spot beams
- Inherent E/W motion of inclined orbit preludes operating GSO spacecraft above 3.4 degrees while maintaining +/- 0.05 E-W tolerance
- Very difficult to operate GSO spacecraft at 2.7 to 3.4 degree inclination while maintaining a +/-0.05 E-W tolerance because of the significant increase in number of required E-W manoeuvres



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# Impact on Inmarsat of +/-0.05 E/W Station Keeping Tolerance

- Would reduce the life of the four Inmarsat 2 spacecraft by 2.5 years each
- Extra fuel expected to be consumed by Inmarsat 3 and 4 spacecraft still being assessed
  - New propulsion systems are more complex



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# Proposed De-Orbiting Requirement

- **Inmarsat's MSS programs are designed for the current standard 192 km de-orbit**
- **A 300 km de-orbit would impact the N-S station keeping budget of MSS spacecraft, both those in-orbit or those under construction**
  - **The orbit height increase modifies the delta velocity requirement from typically 7 m/s to 11 m/s.**
- **Net result would be a 2-3 month reduction of expected in-orbit life of every Inmarsat spacecraft**
- **Three Inmarsat 4 spacecraft under construction have no margin for extra fuel for new de-orbiting requirements**
  - **These are the largest commercial spacecraft being built today**



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# Conclusions

- **Neither the +/- 0.05 E/W stationkeeping tolerance or nor the 300 km de-orbiting requirement should apply to MSS constellations that are in-orbit or under physical construction**
  - **Should not apply to Inmarsat 2, 3 or 4**
  - **Future MSS systems, such as Inmarsat 5, could be designed for the new requirements**
- **Future MSS spacecraft should be allowed to exceed +/- 0.05 E/W if frequency/collision coordination is achieved with neighbouring satellite operators**